App. No. 09/489,878
Amendment Dated: June 14, 2004
Reply to Office Action of February 12, 2004

REMARKS/ARGUMENTS

In the Office Action dated February 12, 2004, the Examiner objected to Claims 1, 5, 6
and 55 because of informalities. Claims 1-5 and 7 are rejected under 35 U.S.C. 112, first
paragraph, as failing to comply with enablement requirements. Claims 9-11, 15, 16, 20, 21, 25,
26, 30, 31, and 54 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for
failing to particularly point out and distinctly claim the subject matter which Applicant regards as
the invention. Claim 6, 8-11, and 52-54 are rejected under 35 U.S.C. 102(b) as being anticipated
by "Points-to Analysis in Almost Linear Time" by Bjarne Steensgaard (hereinafter Steensgaard).
Claims 1-5, 7, 12-14, 16-19, 21-24, 26-29, and 31-36 are rejected under 35 U.S.C. 103(a) as
being unpatentable over Steensgaard in view of "Partial Online Cycle Elimination in Inclusion
Constraint Graphs" by Manuel Fahndrich et al. (hereinafter Fahndrich et al.). Claims 55 and 56
are rejected under 35 U.S.C. 103(a) as being unpatentable over Fahndrich et al. Claims 1, 4-7, 9-
15, 17-20, 22-25, 27-30, 32-36, 52-53, and 55 have been amended. Claims 37-51 have been
canceled. Claims 1-36 and 52-56 remain pending. Applicant respectfully requests
reconsideration and allowance of all pending claims.

I.   Claim Objections

1.)   Claims 1, 5, 6 and 55 are objected to because of informalities. Claims 1, 5, 6, and 55
have been objected to since "[an] other" should be "the other". Claims 1, 5, 6, and 55 have been
amended according to the instructions provided in the Office Action to overcome the identified
informalities without further limiting the scope of the claims. Furthermore, claims 12, 17, 22,
27, and 32 also include the similar language of "an other". Accordingly, claims 12, 17, 22, 27,

and 32 have also been amended to overcome the identified informalities without further limiting the scope of the claims. Applicant respectfully requests reconsideration of claims 1, 5, 6, and 55 in light of these amendments.

2.)   Additionally claim 1 and 5 are objected to for the use of "the" in the phrase "propagating a label of the one of the two locations". Claims 1 and 5 have been amended according to the instructions provided in the Office Action to overcome the identified informalities without further limiting the scope of the claims. Claim 7 also includes the similar language of "propagating a label of the one of the two locations", and has been similarly amended to overcome the identified informalities without further limiting the scope of the claims. Applicant respectfully requests reconsideration of claims 1 and 5 in light of these amendments.

A number of the claims have had additional amendments made due to other noticed informalities. The amendments were made to further clarify the subject matter which Applicant regards as his invention, without further limiting the scope of the claims.

II.   Rejections under 35 U.S.C. § 112

1.)   Claims 1-5 and 7 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The Office Action states that "it is not clear how a label is propagated. . .such that the label of one of the two locations is a subset of the other of the two locations". Applicant respectfully disagrees that the claims are not enabled.

Propagating a label is enabled by the specification. The specification recites, "the act of making a label of a location a subset of a label of another location includes an act of propagating

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the label from one location to another location such that the subset is formed." (Specification page 22, lines 24-26) Furthermore, Figure 10 provides a method member propagate 1014 that is included in data structure 1000. (See Figure 10) The specification states that the method member propagate "causes a propagation of at least one data member symbol 1006 so as to make the data member label 1004 of the one instantiation of the data structure 1000 a subset of a data member label 1004 of the another instantiation of the data structure 1000. As to why the propagation is made, as stated in the title of the application, a label is propagated such that the label of one of the two locations is a subset of the other of the two locations to enhance pointer analysis.

Accordingly, propagating a label is supported by the specification, and Applicant therefore respectfully requests reconsideration of claims 1-5 and 7 in light of the arguments above.

2.)   Claims 9-11, 15, 16, 20, 21, 25, 26, 30, 31 and 54 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention.

With regard to claims 9-11, the Office Action states that "it is not clear from the claim as to what a level is in the context of the claims." Claims 9-11 have been amended to clarify the levels as levels of indirection as used in the specification. In light if these amendments, Applicant respectfully requests reconsideration of claims 9-11.

With regard to claims 15, 20, 25, and 30, the Office Action questions what the language "the first location points to the other of the two locations" implies. Looking at claim 15, claim

15 is dependent on claim 12 through claims 13 and 14. Amended claim 12 recites "forming a relationship between two locations . . .wherein the relationship defines that a label of *one of the two locations* is a subset of a label of *the other of the two locations*, and wherein contents of the two locations are selectively unified." (*emphasis added*) Therefore, claim 12 recites "one of the two locations" and "the other of the two locations". Claim 15 recites a "first location" and a "second location". The "first location" of claim 15 points to "the other of the two locations" recited in claim 12, and the second location" of claim 15 points to the "one of the two locations" recited in claim 12. So, the claims do not imply that the first and second locations simply point to one another, but rather point to the two locations recited in claim 12. Claims 20, 25, and 30 are similar with claim 20 dependent on claim on claim 17 through claims 18 and 19, claim 25 dependent on claim 22 through claims 23 and 24, and claim 30 dependent on claim 27 through claims 28 and 29. Accordingly, Applicant asserts that the claims are not indefinite and requests reconsideration of claims 15, 20, 25, and 30.

With regard to claims 16, 21, 26, and 31, the Office Action questions what the language "determining that the program is correctly typed" means. The terms "well typed" or "correctly typed" are used throughout the specification and refers to whether a program is well typed under a pointer analysis. (See Specification page 13, lines 12-13; page 14, lines 5-7; page 14, lines 15-25; page 16, line 27 - page 17, line 13; page 19, lines 17-28; etc. . .) Well typed or correctly typed with respect to a computer program is a well-known phrase in the art. A program manipulates data. Data has a certain shape, called its *type*, such as integer, string, record, function, etc... Informally, a program is said to be *well typed* when it always manipulates data consistently with its type. For example, a well-typed program might be considered as a program

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that would never treat a data structure as a function and attempt to execute it. Or it might be considered as a program that would never consider the same data sometimes as an integer, and sometimes as an array. In certain embodiments, a well-typed program may be described as a program that does not produce errors due too inconsistent data manipulation. Since correctly typed or well typed are not indefinite terms, Applicant respectfully requests reconsideration of claims 16, 21, 26, and 31.

With regard to claim 54, the Office Action states that the term "about linearly proportional" is indefinite in that it does not define an exact proportion. Applicant respectfully disagrees. "Definiteness problems often arise when words of degree are used in a claim. That some claim language may not be precise, however, does not automatically render a claim invalid." Seattle Box Co., Inc. v. Indus. Crating & Packing, Inc., 731 F.2d 818, 826 (Fed. Cir. 1984). The question becomes whether one of ordinary skill in the art would understand what is claimed when the claim is read in light of the specification. Id. The specification states, "The duration of the acts of processing an assignment statement and forming a relationship are about linearly proportional to the size of the program in theory and in practice." Furthermore, stating that two variables are linearly proportional is providing an exact proportion. Graphically representing linearly proportional variables provides a straight line association between the two variables. This straight line association is exact. However, to state this aspect of the claimed invention with as exactly linearly proportional may be near impossible due to the changing nature of programs themselves. One of ordinary skill in the art would know the range referred to by "about linearly proportional" without requiring further explanation. Accordingly, claim 54 is not indefinite, and reconsideration of claim 54 is respectfully requested.

III.   Rejections under 35 U.S.C. § 102

Claims 6, 8-11, and 52-54 are rejected in the Office Action under 35 U.S.C. 102(b) as being anticipated by Steensgaard. Applicant respectfully disagrees as explained below.

With regard to claim 6, amended claim 6 recites, "defining a relationship between two locations upon an assignment in the program, wherein the two locations are selected to be one level of indirection away from a level associated with the assignment, wherein a label of one of the two locations is associated with a label of the other of the two locations". In graphical form, this limitation is represented by a "flow line", similar to the flow lines shown in Figures 2B, 2C, 4B, 4C, 6B, 6C, 8B, and 8C of the claimed invention. (See also, Specification page 11, line 30 - page 12, line 7) In contrast, this type of relationship is not established in Steensgaard. The Office Action states that equation 1 of Figure 3 in Steensgaard shows this type of relationship. However, this is simply not true. Equation 1 of Figure 3 in Steensgaard is the same as the equation presented in lines 43-46 of page 34, column 1. According to Steensgaard this rule (i.e., equation) "states that each component type of α_2 must be either $\perp$ (non-pointer) or equal to the corresponding type of α_1." (Steensgaard page 34, column 1, lines 47-48) (*emphasis added*) This has nothing to do with forming a relationship between labels. In fact, nowhere in Steensgaard is a relationship that can be graphically represented by a flow line disclosed. Steensgaard, as given by its title, only discloses relationships that are graphically represented by points-to or pointer lines. Furthermore, Steensgaard states that, "We have presented a *flow-insensitive, interprocedural, context-insensitive points-to analysis based on type inference methods. . .*"

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(Steensgaard page 40, column 2, lines 20-21) (*emphasis added*), and "One way to obtain improved results is to develop an efficient *flow-sensitive* algorithm." (Steensgaard page 40, column 2, lines 38-39) (*emphasis added*) Accordingly, Steensgaard admits that the subject of its disclosure does not include the relationship between locations as in claim 6. Since Steensgaard does not disclose defining a relationship between two locations as provided in claim 6, Steensgaard does not anticipate claim 6.

With regard to claims 8-11, claims 8-11 are dependent upon claim 6. Therefore, Steensgaard does not anticipate claims 8-11 for at least the reasons stated above with regard to claim 6.

With regard to claim 52, amended claim 52 recites, "establishing a plurality of flow relationships corresponding to each of the plurality of assignment statements, wherein each of the flow relationships is selected to be established one level of indirection away from each of the assignment statements". Similar to claim 6, this type of relationship is not used in the analysis provided in Steensgaard. Accordingly, similar to reasoning for claim 6 above, Steensgaard does not provide for flow relationships, and therefore does not anticipate claim 52.

With regard to claims 53-54, claims 53-54 are dependent upon claim 52. Therefore, Steensgaard does not anticipate claims 53-54 for at least the reasons stated above with regard to claim 52.

IV.   Rejections under 35 U.S.C. § 103

1.)   Claims 1-5, 7, 12-14, 16-19, 21,24, 26-29, and 31-36 are rejected in the Office Action

under 35 U.S.C. 103(a) as being unpatentable over Steensgaard in view of Fahndrich et al.

Applicant respectfully disagrees as explained below.

With regard to claim 1, amended claim 1 recites, "processing an assignment between two

variables in a program, wherein processing an assignment includes forming a relationship

between two locations that are related to the two variables, wherein the two locations are selected

to be one level of indirection away from a level associated with the assignment". As previously

stated with regard to claim 6 above, Steensgaard does not teach or suggest by its disclosure the

presence of a relationship between two locations as described according to the claimed invention.

Fahndrich et al. does not cure this deficiency of Steensgaard.

The section of Fahndrich et al. cited in the Office Action (page 6, column 1, lines 9-17) is

not actually directed to the Fahndrich et al. method of cycle elimination. Instead, Fahndrich et

al. is presenting a case study for use with their method by presenting "Andersen's Points-to

Analysis". (Fahndrich et al. page 5, column 1, line 16) The Fahndrich et al. method of cycle

elimination does not teach or suggest the claim invention, as it is a separate type of analysis that

searches for cycles in a program to eliminate so that a points-to analysis, such as Andersen's or

the claimed invention may be accomplished more efficiently. (Fahndrich et al. page 1, column 2,

lines 3-28) The claimed invention, instead of using cycle elimination to increase the efficiency,

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selects to form a relationship between two locations that are one level of indirection away from the assignment as recited in claim 1. Fahndrich et al. does not teach this method. Accordingly, Fahndrich et al. and Steensgaard cannot be combined to teach or suggest the claimed invention, as both inventions are missing elements recited in the claims. Since the combination of Steensgaard and Fahndrich et al. does not teach or suggest all of the limitations of amended claim 1, amended claim 1 is patentable over Steensgaard in view of Fahndrich et al.

With regard to claims 2-5, claims 2-5 are dependent upon claim 1. Therefore claims 2-5 are patentable over Steensgaard in view of Fahndrich et al. for at least the reasons stated above.

With regard to claims 7, 12-14, 16-19, 21-24, 26-29, and 31-36, each of these claims includes, or is dependent on a claim that includes a limitation similar to the limitation recited above for amended claim 1. (e.g., claim 6 recites, "defining a relationship between two locations upon an assignment in the program, wherein the two locations are selected to be one level of indirection away from a level associated with the assignment, wherein a label of one of the two locations is associated with a label of the other of the two locations". Claim 12 recites, "forming a relationship between two locations upon an assignment of a first variable and a second variable in the program, wherein the two locations are selected to be one level of indirection away from a level associated with the assignment, wherein the relationship defines that a label of one of the two locations is a subset of a label of the other of the two locations".)

It has already been shown that the combination of Steeengaard and Fahndrich et al. does not teach or suggest forming a relationship between two locations upon an assignment of a first variable and a second variable in the program, wherein the two locations are selectively selected

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to be one level of indirection away from a level associated with the assignment. Accordingly, for

at least the reasons provided above regarding amended claim 1, claims 7, 12-14, 16-19, 21-24,

26-29, and 31-36 are also patentable over Steensgaard in view of Fahndrich et al.

2.) Claims 55-56 are rejected in the Office Action under 35 U.S.C. 103(a) as being

unpatentable over Fahndrich et al. Applicant respectfully disagrees as explained below.

With regard to claim 55, amended claim 55 recites, "wherein the object file contains at

least one relationship between two variables in an assignment statement in the program, wherein

the relationship defines that a set of symbols relating to one of the two variables is a subset of a

set of symbols relating to the other of the two variables, and wherein another relationship is

selectively formed one level of indirection away from a level associated with the assignment

statement between the set of symbols related to one of the two variables and the set of symbols

relating to the other of the two variables." Again, this limitation of selectively forming a

relationship that is one level of indirection away from the level associate with the assignment is

not taught or suggested by Fahndrich et al. Therefore, amended claim 55 is patentable over

Fahndrich et al.

With regard to claim 56, claim 56 is dependent on claim 55. Therefore, claim 56 is

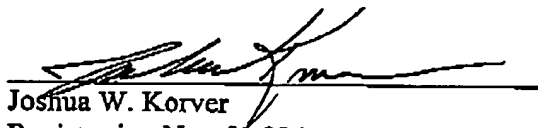patentable over Fahndrich et al. for at least the reasons stated above with regard to claim 55.

In view of the foregoing amendments and remarks, all pending claims are believed to be

allowable and the application is in condition for allowance. Therefore, a Notice of Allowance is

respectfully requested. Should the Examiner have any further issues regarding this application,

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the Examiner is requested to contact the undersigned attorney for the applicant at the telephone

number provided below.

Respectfully submitted,

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